Section 5
Observations for Going Forward

5.1 Correlation with LTCP Recommended Plan

The 2014 flow metering data confirmed that the majority of combined sewer overflows in the City occur through the Cemetery Brook overflow (~70%). The modeled CSO statistics presented in the March 2010 Revised Long-Term CSO Control Plan (LTCP) showed the same high percent of overflows through the Cemetery Brook overflow. Further, the Cemetery Brook overflow yielded the most activations (68), with Stark Brook, second most active (56) for 2014.

The 2014 flow metering program supports the recommended plan from the March 2010 LTCP. The major part of the recommended plan from the LTCP was a $65M investment for removal of Cemetery Brook and $73M investment towards sewer separation of all the contributing catchment areas to the Cemetery Brook Interceptor. The recommended plan will reduce CSOs, improve water quality in the Merrimack River and provide environmental benefit.

5.2 Comparison of Meter Data and LTCP Model Results

In the interest of furthering the pursuit of CSO control in the City as well as validating past planning efforts, specifically the March 2010 Revised Long-Term CSO Control Plan (LTCP), the existing model was run using the recently collected 2014 rain data to compare metered and modeled overflow activations and volumes. To ensure the spatial variation of rainfall events, the 15-minute rain data from each of the three installed gauges was spatially assigned to the most appropriate CSO basin while dry weather flow and infiltration rate assumptions were consistent with the recent modeling efforts completed as part of the March 2010 LTCP.

Table 5-1 includes a summary of the 2014 continuous monitoring data as well as the results of the SWMM simulations which utilized the 2014 rainfall data.

NPDES #	Name	2014 Metered		2014 SWMM Simulation	
		Activations	Volume (MG)	Activations	Volume (MG)
CSO 011	Schiller St	1	0.1	0	-
CSO 018	Ferry St	1	0.6	0	-
CSO 31	Stark Brook	56	21.5	49	11.4
CSO 039	Third St	3	0.2	0	-
CSO 043	Tannery Brook	0	-	0	-
CSO 044	Cemetery Brook	68	261.0	61	235.7
CSO 045	Granite St	17	0.5	3	0.3
CSO 046	Bridge St	54	6.3	4	1.4
CSO 047	Pennacook St	45	21.0	36	11.7
CSO 050	MH1	34	36.2	8	2.7
CSO 051	West Side Pump Station	0	-	0	-
CSO 052	MH2	31	29.1	8	2.4
CSO 053	West Pennacook St	0	-	0	-
CSO 054	Ray Brook	6	0.3	15	1.1
CSO 055	Dunbar St	11	0.3	4	1.0
	2014 Total		**377.1**		**267.7**

Table 5-1
Comparison of 2014 Meter and SWMM Model Simulation

A few notable observations when comparing the data include the following:

- The annualized total overflow volume resulting from the model simulations was within 28% percent of the actual metered total. This deviation is greater than 2013 (7%). The reason for the larger deviation was the historical baseline sewer flow was used when running the simulation instead of actual 2014 hourly WWTP flows. The historical baseline sewer flow provides diurnal flow and the impacts of snowmelt/infiltration, but doesn't directly represent 2014 conditions;
- The model matched the observation that the Tannery Brook, West Side Pump Station, and West Pennacook Street CSOs did not experience any CSO activations in 2014;
- The model matched well the outfalls at Cemetery Brook (10% deviation) and Granite Street (18% deviation) but measured over four times greater than modeled at Bridge Street. However, it should be noted that these two CSO basins (Granite Street and Bridge Street) contain significant interconnections with the Cemetery Brook CSO basin and it is possible that the modeling of some upstream interconnections require further refinement during future phases of preliminary design work in these areas. Further, the total overflow volume metered (267.7 MG) and predicted by the SWMM model (237.4 MG) were less than 11% from each other for this Cemetery Brook/Granite Street/Bridge Street basin;
- The remaining four CSOs contributing to the overflow volume had poor connection with the model, Penacook Street (44% deviation), Stark Brook (47% deviation), Manhole #1 (92% deviation) and Manhole #2 (91% deviation). Similar to the first bullet point, the larger deviation is due to the use of the historical baseline sewer flow instead of hourly WWTP flows. Further, the operation of the flow into the WWTP may have been different in 2014, then the operation rule in the SWMM model; and

- The model under predicts 2014 activations and CSO volume at Manhole No. 1 and Manhole No. 2 by over 55 MG. It is surmised that this variation is related to the model assumptions (that assumed a fixed flow entering the WWTP) as compared to actual operations at the Crescent Road pump station which can vary between rainfall events. Further, Manhole #1 and Manhole #2 as the closest to the WWTP and impacted directly by the plant operation and water levels in the interceptor.

5.3 Future Flow Monitoring

The City's recommended 20-year plan as outlined in the March 2010 LTCP represents a major financial ($165M) and environmental commitment. Therefore, the City has taken an additional step to further verify CSO overflow volumes and activations by continuing the CSO flow monitoring for the 2015 calendar year. The goal for flow monitoring a third year is to provide additional validation of overflows and supporting data for the recommended March 2010 Revised LTCP.

5.4 Other Beneficial Projects

The City is currently under construction for aeration upgrades at the Wastewater Treatment Plant (WWTP) that will increase flow capacity from 65 mgd to 85 mgd at the plant. The plant upgrades will allow greater wet weather treatment capacity and help lower CSO volumes and reduce wet weather bypassing. This project, is expected to be completed in early 2016. The City has started a new WWTP project, a primary clarifier upgrade. This project is under design and is expected to be constructed in 2016/2017. Both of these projects are part of the $20M in improvements at the WWTP included in the March 2010 LTCP recommended plan.

The City is also underway with an $18 million, two phased sewer separation project in the Chestnut Street Area. The first construction contract separating the lower basin has been completed. The second construction contract began in 2014 and will be completed in 2016. This project was included in the March 2010 LTCP recommended plan and provides immediate local flooding and sewer backup relief for area residents, the City's largest Fire Station and several other key stakeholders. The City is also constructing sewer system improvements under Phase II of their CMOM program. These three sewer projects further help separate the City's combined system.

The City expects to move forward with another March 2010 LTCP recommended plan initiative, system optimization. The 2013 and 2014 flow monitoring data revealed three CSO locations with no activations and six CSO locations with very low activations and volumes representing less than 1% of the total annual CSO discharges. These CSO locations can be mitigated with minor modifications and optimizations. The system optimizations may include raising weir walls and modifying MHs to allow for less frequent overflows.